

DETAILED ACTION

Title

1. The title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed.

The following title is suggested: Fuel cell having heating means.

Specification

2. The disclosure is objected to because of the following informalities: At [0118]/L2 of the instant specification, Reference number 1333 is labeled as "high-concentration fuel tank" when it should be "low-concentration fuel tank".

Appropriate correction is required.

Claim Rejections - 35 USC § 112

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claim 10 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The claim limitation "a fuel recoverer for recovering the fuel having passed through the fuel electrode into the heater" is indefinite because it is unclear whether the fuel recoverer recovers the fuel after the fuel passed through the fuel electrode and then sends it to the heater (as supported in Fig. 19), or if the fuel recoverer recovers fuel from both the fuel electrode and the heater (as supported in Fig. 22). For the purpose of this Office Action, said claim limitation has been taken to mean

the fuel recoverer recovers the fuel after the fuel passed through the fuel electrode and then sends it to the heater (as supported in Fig. 19).

Claim Rejections - 35 USC § 102

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

6. Claims 1-4 are rejected under 35 U.S.C. 102(b) as being anticipated by Hayashi et al. (US 2002/0146610).

Regarding claim 1, Hayashi discloses a fuel cell comprising [0101]: a unit cell (fuel cell, [0101]/L1) that includes a solid electrolyte membrane ([0101]/L3-4), a fuel electrode (anode, [0101]/L2) and an oxidizer electrode (cathode, [0101]/L2) disposed on the solid electrolyte membrane ([0101]/L3-4); a heater for heating the unit cell (heating device for heating each cell, [0265]); and a fuel supplying system for supplying fuel to the fuel electrode (hydrogen supply system, [0271]), part of the fuel is supplied from the fuel supplying system to the heater ([0271]) and heat generated when the fuel supplied to the heater is combusted by the heater is conducted to the unit cell so that the unit cell is heated ([0265]).

Regarding claim 2, Hayashi discloses all of the claim limitations as set forth above. Hayashi further discloses the heater comprises a heating element and a heat conductor in contact with the heating element ([0269]).

Regarding claim 3, Hayashi discloses all of the claim limitations as set forth above. Hayashi further discloses the heater includes a heating catalyst used for combusting the fuel ([0269]).

Regarding claim 4, Hayashi discloses all of the claim limitations as set forth above. Hayashi further discloses the heater is in contact with the oxidizer electrode (Fig. 25).

7. Claims 1, 2, and 4 are rejected under 35 U.S.C. 102(a, e) as being anticipated by Yamada (US 2004/0048124).

Regarding claim 1, Yamada discloses a fuel cell comprising [0028]: a unit cell (power generating cell, [0028]/L2) that includes a solid electrolyte membrane ([0029]/L1-2), a fuel electrode (anode, [0028]/L3) and an oxidizer electrode (air, [0028]/L4) disposed on the solid electrolyte membrane ([0028]/L5-6); a heater for heating the unit cell ([0035-0036]); and a fuel supplying system for supplying fuel to the fuel electrode (fuel supply system, Fig. 1), part of the fuel is supplied from the fuel supplying system to the heater ([0036]) and heat generated when the fuel supplied to the heater is combusted by the heater is conducted to the unit cell so that the unit cell is heated ([0035]).

Regarding claim 2, Yamada discloses all of the claim limitations as set forth above. Yamada further discloses the heater comprises a heating element and a heat conductor in contact with the heating element ([0036], [0038]).

Regarding claim 4, Yamada discloses all of the claim limitations as set forth above. Yamada further discloses the heater is in contact with the oxidizer electrode (inherently, the heater is in thermal contact with the oxidizer electrode, [0038]/L11-13).

Claim Rejections - 35 USC § 103

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

9. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

10. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was

not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

11. Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hayashi et al. (US 2002/0146610), as applied to claim 1 above, in view of Colbow et al. (US 2003/0003336).

Regarding claim 5, Hayashi discloses all of the claim limitations as set forth above, but does not explicitly disclose liquid fuel is supplied directly to the fuel electrode. However, it would have been obvious to one having ordinary skill in the art at the time of the invention to use a liquid fuel to be supplied directly to the fuel electrode of Hayashi since this design of fuel cell is well known in the art (as evidenced by Colbow: [0009]/L1-4) and one having ordinary skill in the art at the time of the invention would have had reasonable expectation of success in doing so (as evidenced by Colbow: [0009]/L4-6).

12. Claims 6-9, 13, and 14 rejected under 35 U.S.C. 103(a) as being unpatentable over Hayashi et al. (US 2002/0146610), as applied to claim 1 above, in view of Pratt et al. (US 6127058).

Regarding claim 6, Hayashi discloses all of the claim limitations as set forth above. Hayashi further discloses a plurality of unit cells (fuel cell stack, [0101]/L7-8) wherein a unit cell is composed of a pair of a first electrode and a second electrode opposed to each other, and a solid electrolyte membrane ([0101]/L1-4).

Hayashi does not explicitly disclose a plurality of first electrodes that are provided on one side of the solid electrolyte membrane; and a plurality of second electrodes that are provided on the solid electrolyte membrane, where one second electrode is disposed opposite one first electrode; and the heater heats a plurality of the unit cells.

Pratt teaches a planar fuel cell (Title). Pratt further teaches a plurality of first electrodes that are provided on one side of the solid electrolyte membrane; and a plurality of second electrodes that are provided on the solid electrolyte membrane, where one second electrode is disposed opposite one first electrode (C3/L62-67). Pratt further teaches that planar fuel cells have an advantage over standard stacked cells in that many of the seals, gas piping, and electrical interconnections can be eliminated (C4/L31-38).

Hayashi and Pratt are combinable because they are concerned with the same field of endeavor, namely, fuel cells.

It would have been obvious to one having ordinary skill in the art at the time of the invention to incorporate the teachings of Pratt, namely, use of a planar fuel cell design, for the fuel cell as disclosed by Hayashi in order to be able to eliminate many of the seals, gas piping, and electrical interconnections. Further, the heater as disclosed by Hayashi would inherently heat a plurality of the unit cells of modified Hayashi.

Regarding claim 7, modified Hayashi discloses all of the claim limitations as set forth above. Hayashi further discloses a temperature sensor for measuring a heating temperature of the fuel cell ([0270]); and a controller for controlling supply of fuel from

the fuel supplying system to the heater based on the temperature measured by the temperature sensor (ECU, [0270], [0271], and [0277]/L12-17).

Regarding claim 8, modified Hayashi discloses all of the claim limitations as set forth above. Hayashi further discloses the heater is in thermal contact with the solid electrolyte membrane (Fig. 25).

Regarding claim 9, modified Hayashi discloses all of the claim limitations as set forth above. Hayashi further discloses the heater is in thermal contact with a plurality of the first electrodes (as described by modified Hayashi above, Fig. 25).

Regarding claim 13, modified Hayashi discloses all of the claim limitations as set forth above. Hayashi further discloses a controller for controlling the heating temperature of the heater by cooling water (ECU, [0276], [0280], and [0109]).

Regarding claim 14, modified Hayashi discloses all of the claim limitations as set forth above. Hayashi further disclose an oxidizer supplier for supplying an oxidizer to the heater ([0271]).

13. Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hayashi et al. (US 2002/0146610), as applied to claim 1 above, in view of Kuetz et al. (WO 0103216, see Machine Translation).

Regarding claim 10, Hayashi discloses all of the claim limitations as set forth above, but does not explicitly disclose a fuel recoverer for recovering the fuel after the fuel passed through the fuel electrode and then sending it to the heater.

Kuetz discloses a similar device for heating/cooling a fuel cell and fuel cell system (Title). Keutz further teaches that it is possible to operate a burner on the

exhaust streams of the fuel cell since the exhaust of the fuel cell contains still-combustible components (P2/[0007]).

Hayashi and Keutz are combinable because they are concerned with the same field of endeavor, namely fuel cell systems including heaters.

It would have been obvious to one having ordinary skill in the art at the time of the invention to include a recovering means to recover the exhaust of a fuel cell as taught by Keutz so to use it in the heater of Hayashi, in order to minimize the wasting of any of the combustible components, and one having ordinary skill in the art at the time of the invention would have had reasonable expectation of success in doing so.

14. Claims 11 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hayashi et al. (US 2002/0146610) in view of Pratt et al. (US 6127058) as applied to claim 6 above, and further in view of Colbow et al. (US 2003/0003336).

Regarding claim 11, modified Hayashi discloses all of the claim limitations as set forth above, but does not explicitly disclose the fuel supplying system comprises a high-concentration fuel supplier for supplying fuel having concentration higher than that of fuel supplied to the fuel electrode, to the heater.

Colbow teaches a fuel supplying system comprises a high-concentration fuel supplier for supplying fuel having concentration higher than that of fuel supplied to the fuel electrode (the fuel reservoir has a higher concentration fuel than the gas/liquid separator, [0046]).

Modified Hayashi and Colbow are combinable because they are concerned with the same field of endeavor, namely fuel cells.

It would have been obvious to one having ordinary skill in the art at the time of the invention to use a liquid fuel to be supplied directly to the fuel electrode of Hayashi since this design of fuel cell is well known in the art (as evidenced by Colbow: [0009]/L1-4) and one having ordinary skill in the art at the time of the invention would have had reasonable expectation of success in doing so (as evidenced by Colbow: [0009]/L4-6). Further, it would have been obvious to one having ordinary skill in the art at the time of the invention to incorporate the teachings of Colbow, namely, a high-concentration fuel supplier, into the fuel cell system of modified Hayashi in order to better control the temperature of the fuel cell (as evidenced by Colbow: [0046]/L7-12).

Regarding claim 12, modified Hayashi discloses all of the claim limitations as set forth above. Colbow further teaches a fuel mixer for mixing high-concentration fuel supplied from the high-concentration fuel supplier and fuel supplied to the fuel electrode (Fig. 1, Reference numeral: 5a).

15. Claims 3 and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yamada (US 2004/0048124), as applied to claim 1 above, in view of Kuetz et al. (WO 0103216, see Machine Translation).

Regarding claim 3, Yamada discloses all of the claim limitations as set forth above, but does not explicitly disclose the heater includes a heating catalyst used for combusting the fuel. However, catalytic burners are well known in the art (as evidenced by Kuetz: P2/[0007]), thus it would have been obvious to one having ordinary skill in the art at the time of the invention to provide the combustor of Yamada with catalyst in order

to facilitate the combustion of fuel and one having ordinary skill in the art at the time of the invention would have had reasonable expectation of success in doing so.

Regarding claim 10, Yamada discloses all of the claim limitations as set forth above, but does not explicitly disclose a fuel recoverer for recovering the fuel after the fuel passed through the fuel electrode and then sending it to the heater.

Kuetz discloses a similar device for heating/cooling a fuel cell and fuel cell system (Title). Keutz further teaches that it is possible to operate a burner on the exhaust streams of the fuel cell since the exhaust of the fuel cell contains still-combustible components (P2/[0007]).

Yamada and Keutz are combinable because they are concerned with the same field of endeavor, namely fuel cell systems including heaters.

It would have been obvious to one having ordinary skill in the art at the time of the invention to include a recovering means to recover the exhaust of a fuel cell as taught by Keutz so to use it in the heater of Yamada, in order to minimize the wasting of any of the combustible components, and one having ordinary skill in the art at the time of the invention would have had reasonable expectation of success in doing so.

16. Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over Yamada (US 2004/0048124), as applied to claim 1 above, in view of Colbow et al. (US 2003/0003336).

Regarding claim 5, Yamada discloses all of the claim limitations as set forth above, but does not explicitly disclose liquid fuel is supplied directly to the fuel electrode. However, it would have been obvious to one having ordinary skill in the art at

the time of the invention to use a liquid fuel to be supplied directly to the fuel electrode of Yamada since this design of fuel cell is well known in the art (as evidenced by Colbow: [0009]/L1-4) and one having ordinary skill in the art at the time of the invention would have had reasonable expectation of success in doing so (as evidenced by Colbow: [0009]/L4-6).

17. Claims 6, 8, 9, 13, and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yamada (US 2004/0048124), as applied to claim 1 above, in view of Pratt et al. (US 6127058).

Regarding claim 6, Yamada discloses all of the claim limitations as set forth above. Yamada further discloses a plurality of unit cells (fuel cell stack, [0028]/L1-2) wherein a unit cell is composed of a pair of a first electrode and a second electrode opposed to each other, and a solid electrolyte membrane ([0028]/L2-6).

Yamada does not explicitly disclose a plurality of first electrodes that are provided on one side of the solid electrolyte membrane; and a plurality of second electrodes that are provided on the solid electrolyte membrane, where one second electrode is disposed opposite one first electrode; and the heater heats a plurality of the unit cells.

Pratt teaches a planar fuel cell (Title). Pratt further teaches a plurality of first electrodes that are provided on one side of the solid electrolyte membrane; and a plurality of second electrodes that are provided on the solid electrolyte membrane, where one second electrode is disposed opposite one first electrode (C3/L62-67). Pratt further teaches that planar fuel cells have an advantage over standard stacked cells in

that many of the seals, gas piping, and electrical interconnections can be eliminated (C4/L31-38).

Yamada and Pratt are combinable because they are concerned with the same field of endeavor, namely, fuel cells.

It would have been obvious to one having ordinary skill in the art at the time of the invention to incorporate the teachings of Pratt, namely, use of a planar fuel cell design, for the fuel cell as disclosed by Yamada in order to be able to eliminate many of the seals, gas piping, and electrical interconnections. Further, the heater as disclosed by Yamada would inherently heat a plurality of the unit cells of modified Hayashi.

Regarding claim 8, modified Yamada discloses all of the claim limitations as set forth above. Yamada further discloses the heater is in thermal contact with the solid electrolyte membrane (inherently, the heater is in thermal contact with the solid electrolyte membrane, [0038]/L11-13).

Regarding claim 9, modified Yamada discloses all of the claim limitations as set forth above. Yamada further discloses the heater is in thermal contact with a plurality of the first electrodes (inherently, the heater is in thermal contact with a plurality of the first electrodes, [0038]/L11-13, as described by modified Yamada above).

Regarding claim 13, modified Yamada discloses all of the claim limitations as set forth above. Yamada further discloses a controller for controlling the heating temperature of the heater by cooling water (antifreeze solution contains water and there is necessarily a controller to control the change-over valves to allow the heating temperature of the heater to be controlled, [0035]).

Regarding claim 14, modified Yamada discloses all of the claim limitations as set forth above. Yamada further disclose an oxidizer supplier for supplying an oxidizer to the heater ([0036]).

18. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Yamada (US 2004/0048124 in view of Pratt et al. (US 6127058) as applied to claim 6 above, and further in view of Kanbara et al. (JP 2000-149970, see Machine Translation).

Regarding claim 7, modified Yamada discloses all of the claim limitations as set forth above, but does not explicitly disclose a temperature sensor for measuring a heating temperature of the fuel cell; and a controller for controlling supply of fuel from the fuel supplying system to the heater based on the temperature measured by the temperature sensor.

Kanbara teaches a similar fuel cell system [0013]. Kanbara further teaches a temperature sensor for measuring a heating temperature of the fuel cell ([0013]/L8); and a controller for controlling supply of fuel from the fuel supplying system to the heater based on the temperature measured by the temperature sensor ([0013]/L7).

Modified Yamada and Kanbara are combinable because they are concerned with the same field of endeavor, namely, fuel cell systems.

It would have been obvious to one having ordinary skill in the art at the time of the invention to incorporate the teachings of Kanbara, namely including a temperature sensor and a controller into the fuel cell system as disclosed by modified Yamada so to enable the heating process of Yamada ([0036] and [0038]) to be automated and for the fuel cell stack to maintain an optimum temperature ([0034])

19. Claims 11 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yamada (US 2004/0048124 in view of Pratt et al. (US 6127058) as applied to claim 6 above, and further in view of Colbow et al. (US 2003/0003336).

Regarding claim 11, modified Yamada discloses all of the claim limitations as set forth above, but does not explicitly disclose the fuel supplying system comprises a high-concentration fuel supplier for supplying fuel having concentration higher than that of fuel supplied to the fuel electrode, to the heater.

Colbow teaches a fuel supplying system comprises a high-concentration fuel supplier for supplying fuel having concentration higher than that of fuel supplied to the fuel electrode (the fuel reservoir has a higher concentration fuel than the gas/liquid separator, [0046]).

Modified Yamada and Colbow are combinable because they are concerned with the same field of endeavor, namely fuel cells.

It would have been obvious to one having ordinary skill in the art at the time of the invention to use a liquid fuel to be supplied directly to the fuel electrode of Hayashi since this design of fuel cell is well known in the art (as evidenced by Colbow: [0009]/L1-4) and one having ordinary skill in the art at the time of the invention would have had reasonable expectation of success in doing so (as evidenced by Colbow: [0009]/L4-6). Further, it would have been obvious to one having ordinary skill in the art at the time of the invention to incorporate the teachings of Colbow, namely, a high-concentration fuel supplier, into the fuel cell system of modified Yamada in order to better control the temperature of the fuel cell (as evidenced by Colbow: [0046]/L7-12).

Regarding claim 12, modified Yamada discloses all of the claim limitations as set forth above. Colbow further teaches a fuel mixer for mixing high-concentration fuel supplied from the high-concentration fuel supplier and fuel supplied to the fuel electrode (Fig. 1, Reference numeral: 5a).

Conclusion

20. Any inquiry concerning this communication or earlier communications from the examiner should be directed to JONATHAN G. LEONG whose telephone number is (571) 270-1292. The examiner can normally be reached on M-Th 8:00 AM - 5:00 PM (EST).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Basia Ridley can be reached on (571) 272-1453. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/J. G. L./
Examiner, Art Unit 1795
3/25/2010

/Basia Ridley/
Supervisory Patent Examiner, Art Unit 1795